Effect of Ar^+ Treatment on Thermal Stability and Micromechanical Properties of $Fe_{75}Mo_5Si_6B_{14}$ Amorphous Alloy

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Experimental studies were performed to determine the effect of Ar+ treatment on the parameters of thermal stability and micromechanical properties of $Fe_{75}Mo_5Si_6B_{14}$ amorphous alloy.

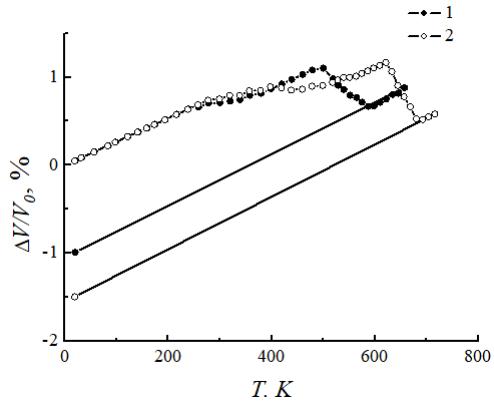

Fig. 1. Results of the dilatometric experiment for the original $Fe_{75}Mo_5Si_6B_{14}$ amorphous alloy (1) and after ion etching for 25 minutes (2)

Parameters of Thermal Stability of the Original Amorphous alloy and treated with Argon Ions

Processing time, minutes	The temperature of the beginning of intensive crystallization, ^{0}C	Change in the temperature of the beginning of intensive crystallization, ^{0}C.
The original sample $Fe_{75}Mo_5Si_6B_{14}$	500	
Treatment with Ar+ ions, U = 1 кВ, I = 1мА.		
5	580	**80**
10	585	**85**
15	600	**100**
25	620	**120**

- It is shown, that after Ar^+ treatment of the amorphous alloy for (5-25) minutes, the thermal stability interval expanded by (30-120) K, respectively.

Microhardness of the Original Amorphous alloy and treated with Argon Ions

Processing time, minutes	Hv, GPa	$(Hv - H_0)/H_0$, %
The original sample $Fe_{75}Mo_5Si_6B_{14}$	**H_0 = 8,69**	
Treatment with Ar+ ions, U = 1 кВ, I = 1мА.		
5	8,91	**2,5**
10	9,03	**3,9**
15	8,04	**-7,5**
25	7,52	**- 13,4**

When treating an amorphous alloy by Ar^+ for (5-10) minutes, the relative change in microhardness is (2.5-4)%, i.e. is within the experimental error (5%). When treating $Fe_{75}Mo_5Si_6B_{14}$ amorphous alloy for (15-25) minutes, the microhardness decreases by (7,5-13,4)%, i.e. the effect of plasticization is observed. The effects of expanding the interval of thermal stability and plasticization of the amorphous alloy can be explained by the dissolution of frozen crystallization centers.

Figure 2 shows the results of studies of the surface morphology of the $Fe_{75}Mo_5Si_6B_{14}$ amorphous alloy after irradiation with argon ions. The formation of a (200x400) nm crater caused by the implantation of argon ions is visible on the surface of the alloy. For the original amorphous alloy, the size of the frozen crystallization centers is 20 nm on average. As can be seen from the figure, the size of the frozen centers of crystallization decreased after irradiation with argon ions and has a size of the order of 5 nm.

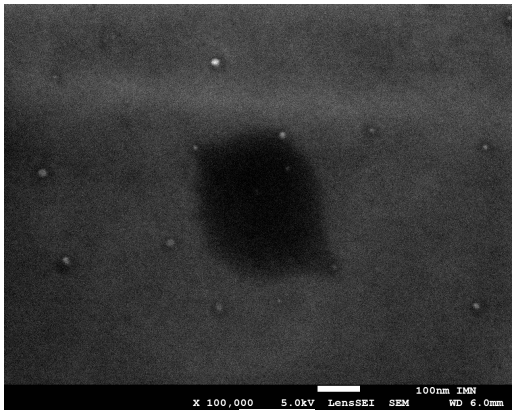

Fig.2.

This fact is confirmed by studies of the morphology of the amorphous alloy surface. The surface of the amorphous alloy changes dramatically after Ar+ treatment: small grains disappear, which indicates that frozen crystallization centers dissolve in the amorphous matrix due to action of argon ions flux.